

Claims

- Sub. a2
- [c1] 1. A method for producing nitrogen using a pressure swing adsorption (PSA) method with air as a raw material, comprising:
having the air contact with an adsorbent that comprises a carbon molecular sieve selectively adsorbing oxygen to produce nitrogen by using the pressure swing adsorption (PSA) method, wherein
a period "TO" needed for the carbon molecular sieve to adsorb an oxygen amount of 50% of a saturated oxygen adsorption amount starting from the beginning of oxygen supply is 5~10 seconds, and a period "TN" needed for the carbon molecular sieve to adsorb a nitrogen amount of 50% of a saturated nitrogen adsorption amount starting from the beginning of nitrogen supply is larger than "TO" by more than 41 times.
- [c2] 2. The method of claim 1, wherein a production rate of the nitrogen product with one ton of adsorbent is higher than $100\text{Nm}^3/\text{h}$ as an oxygen concentration in the nitrogen product is 100ppm, higher than $150\text{Nm}^3/\text{h}$ as the oxygen concentration is 1000ppm, or higher than $250\text{Nm}^3/\text{h}$ as the oxygen concentration is 10000ppm, wherein the oxygen concentration serves as a purity indicator of the nitrogen product.
- [c3] 3. The method of claim 1, wherein a processing rate of the air with one ton of adsorbent is less than $500\text{Nm}^3/\text{h}$ as an oxygen concentration in the nitrogen product is 100ppm, less than $570\text{Nm}^3/\text{h}$ as the oxygen concentration is 1000ppm, or less than $690\text{Nm}^3/\text{h}$ as the oxygen concentration is 10000ppm, wherein the oxygen concentration serves as a purity indicator of the nitrogen product.
- Sub. a2
- [c4] 4. An apparatus for producing nitrogen using air as a raw material, comprising:
an air compressor for compressing the air;
a dryer for removing water from the compressed air;
at least one adsorbing column into which the dried and compressed air is conducted, the adsorbing column being filled with an adsorbent that selectively adsorbs oxygen; and
a product tank for temporarily storing a nitrogen product conducted out of the

adsorbing column after oxygen is removed in the adsorbing column, wherein in said at least one adsorbing column, an adsorption step and a depressurization regeneration step are switched alternatively and periodically to implement a pressure swing adsorption (PSA) process, wherein the adsorption step comprises conducting a raw air compressively into the adsorbing column, and the depressurization regeneration step comprises releasing a compressed gas after the adsorption step; and the adsorbent is a carbon molecular sieve that selectively adsorbs oxygen, which adsorbs an oxygen amount of 50% of a saturated oxygen adsorption amount with a period "TO" of 5~10 seconds starting from the beginning of oxygen supply, and adsorbs a nitrogen amount of 50% of a saturated nitrogen adsorption amount with a period "TN" starting from the beginning of nitrogen supply, wherein TN is larger than TO by more than 41 times.